



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

**Subject: HAZARDS OF ROTATING PROPELLER
AND HELICOPTER ROTOR BLADES**

Date: 3/3/83
Initiated by: AWS-340

AC No: 91-42D
Change:

1. PURPOSE. This advisory circular **updates** statistical information on propeller- **and** rotor-to-person accidents **and** offers suggestions to **reduce** the frequency of those accidents.
2. CANCELLATION. AC 91-42C, Hazards of Rotating Propeller **and** Helicopter Rotor Blades, dated May 22, 1981, is **canceled**.
3. BACKGROUND. A review of National Transportation Safety Board reports of propeller- **and** rotor-to-person accidents for the years 1979, 1980, **and** 1981, **showed** a total of 54. Of those accidents, **two were** the result of helicopter rotors which caused two serious injuries. The 52 propeller accidents caused 9 fatalities **and** 45 serious injuries. In two of the propeller accidents, two persons received serious injuries. Propeller- **and rotor-to-person** accidents are a small percentage of the total aircraft accidents. With proper education **and** discipline, **those** accidents could **be** reduced to zero. The following chart summarizes the events **leading** to the **various** accidents.

EVENTS LEADING TO THE ACCIDENT	FATALITIES	SERIOUS INJURIES
Passengers deplaning aircraft with operating engine(s)	2	16
Passengers enplaning aircraft with operating engine(s)	1	3
Handcranking of propellers by pilot	1	9
Handcranking of propeller by passengers	0	2
Pilot working on aircraft with engine(s) operating	0	2
Passengers assisting pilot taxiing and parking	2	1
Bystanders in vicinity of operating aircraft	2	7
Ground personnel working near aircraft with operating engine(s)	1	2
Propeller blade separation	0	0
Ground personnel working near helicopters with rotor in motion	0	2
Handcranking of propellers by ground crew	0	2
Pilot exiting aircraft with engine operating	0	1

4. GENERAL. It is particularly tragic that propeller- and rotor-to-person accidents, along with airmen, have included bystanders, passengers, and children among the injured persons. Propeller- and rotor-to-person accidents differ from other aircraft accidents in that they usually result in fatal or serious injury. This is due to the fact that a propeller or rotor rotating under power, even at slow idling speed, has sufficient force to inflict serious injury. It should be remembered that a rotating propeller or rotor is extremely dangerous and should be treated with all due caution.

5. CONSPICUITY. The propeller or rotor is difficult to see when in operation, and the nonprofessional public is often not aware of its danger. Even personnel familiar with the danger of a turning propeller or rotor are likely to forget it.

a. Some manufacturers of propeller and rotor blades use paint schemes to increase the conspicuity of the blades. Owners should give strong consideration to maintaining the conspicuity paint scheme of the original manufacturer.

b. In the event that the paint scheme does not lend itself to conspicuity, the owner should consider having the blade repainted. A customized paint scheme should not be used until an evaluation is made by a person qualified to determine that it will not interfere with the pilot's visibility, promote vertigo, or create an unbalanced blade condition.

c. In August of 1978, the FAA issued Report No. FAA-AM-78-29, Conspicuity Assessment of Selected Propeller and Tail Rotor Paint Schemes. The report summarizes the evaluation of three paint schemes for airplane propellers and two for helicopter tail rotor blades. The document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

6. NONFLIGHT CREW PERSONNEL. Persons directly involved with enplaning or deplaning passengers and aircraft servicing should be instructed as to their specific duties through proper training, with emphasis placed on the dangers of rotating propellers and rotors. Ramp attendants and passenger-handling personnel should be made aware of the proper procedures and methods of directing passengers to and from parked aircraft. The following safety measures should be considered to help prevent accidents on airport ramp areas:

a. When the possibility of passengers wandering on the ramp exists, physical barriers should be provided such as rope stanchions from the aircraft to the terminal doors.

b. Airport management personnel should be on the alert to keep unauthorized persons from milling around on ramps among parked aircraft. When spectators are permitted to view and move among aircraft parked on a ramp, the airport management personnel should caution those persons to stay clear of all propellers and not touch or move them.

c. Helicopter **landing and ramp** areas **should** be marked and provided with safety barriers to restrict **access** by unauthorized persons.

d. Tail rotor danger areas **should** be clearly marked on ramp areas. Helicopters should be parked with tail rotors within the marked area.

7. AIRCRAFTSERVICE PERSONNEL. Persons directly **involved** with aircraft **service** are **most vulnerable** to injuries by **propellers** or rotors. **Working** around aircraft places them in the **most** likely position for possible propeller or rotor accidents. Aircraft service **personnel** should develop the following safety habits:

a. Treat all **propellers** as **though** the ignition switches are **"on."**

b. Chock airplane wheels before **working** around aircraft.

c. Use wheel chocks **and** parking brakes before starting **engines** or **handcranking** engines. **Handcranking** a starter-equipped **engine** with a low battery or defective starter, although convenient, can expose personnel to a possible accident. For safety reasons, the replacement of the faulty starter **and** the use of a ground power **source** should be **considered** rather than **handcranking**. Only **experienced** persons should do the **handcranking** with a reliable person in the cockpit. **Handcranking** with the cockpit unoccupied has resulted in accidents.

d. Attach **pull** ropes to **pull** chocks **from** wheels close to rotating propeller or rotor blades.

e. After an **engine** run **and** before the **engine** is **shut** down, perform an ignition switch test to detect a faulty ignition switch. Follow the **manufacturer's recommendations** for the switch test **and** the **procedures to be** followed when a faulty switch is found. Applicable airworthiness directive requirements related to ignition switches have been issued to help locate **and** eliminate faulty switches.

f. **Before moving** a propeller or **connecting** an external power **source** to an aircraft, be sure that the aircraft is chocked, ignition switches are in the "off" position, throttle is closed, mixture is in "idle cut-off" **posi-**tion, **and** all **equipment and** personnel are clear of the **propeller** or rotor. Faulty diodes in aircraft electrical systems have caused starters to **engage** when external power was applied regardless of the switch position.

g. **Remember** when **removing** an external power **source** **from** an aircraft, keep the equipment **and** yourself clear of the propeller or rotor.

h. Always **stand** clear of rotor and propeller blade paths, especially when **moving** the propeller. Particular caution should be practiced around **warm engines**.

i. Ground personnel **should** be given recurrent propeller **and** rotor safety lectures to keep them alert to dangers when **working** around helicopters and fixed-wing aircraft.

j. Before removing chocks, signal pilot to **hold** brakes or apply **parking** brake.

k. Be sure all equipment **and** personnel are clear of an aircraft before giving the pilot the signal to depart.

8. FLIGHT PERSONNEL AND FLIGHT INSTRUCTORS. Prior to **starting an engine**, flight personnel should make certain that all personnel are clear of the **propeller** or rotor.

a. The **engine** of a fixed-wing aircraft or of a helicopter should be shut down before boarding or deplaning passengers. This is the simplest method of avoiding accidents.

b. **Boarding or deplaning of passengers, with an engine running, should** only be allowed under close **supervision.** The pilot **in command** should have **knowledge** that either the **company** or the airport operator has ground **attendants fully trained** in their **specific** duties to **board** or **deplane** passengers **from** an aircraft with an engine(s) **running.** The pilot **should** instruct **passengers,** before they exit an aircraft with an **engine(s) running,** the path to follow to avoid the propeller or rotor blades.

c. When it is **necessary** to discharge a **passenger** from an aircraft on which an **engine** is running, never stop the aircraft with the propeller in the **path** of the passenger's route from the aircraft.

d. When flight **and** ground instructors are **instructing** their students about propellers or rotors, they **should** emphasize the **dangers** of rotating propeller **and** rotor blades. Students should be taught the techniques **and** safety procedures for **handcranking,** at-d how to **determine** which **engines** **should** not be **hat-&ranked.** Safety through education is the best **and most** positive means available **for** reducing potential accidents from **rotating** propeller **and** rotor blades.

e. The **prestart** portion of the checklist **should** include an item to make sure the propeller or rotor blades are clear. The **proper use** of the aircraft checklist **should** be taught **to** all student pilots.

f. Flight **personnel should perform** an ignition switch test prior to **engine** shutdown to detect faulty switches. (See **item 7e.**) The checklist **should** include an item for that test to be made **and** an item to assure that the switch is off before **leaving** the cockpit.

9. SUMMARY.

a. In reviewing propeller- and rotor-to-person accidents, the most impressive fact is that every one of them was preventable. The **danger** of rotating propeller or rotor blades is universally recognized.

b. The pilot can be most effective in **ensuring** that his or her **passengers** arrive and depart the vicinity of the airplane safely by stopping the **engine completely** at the time of **loading and** unloading-, or by **providing** a definite **means** of keeping **them** clear of the propeller if it is left in motion.

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c. **Prominent warning** signs, placed in the aircraft's interior near or on the **inside** face of the aircraft doors to alert **passengers and crewmembers** of **propeller** or rotor hazards, could be helpful in **preventing** accidents.



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